

Winter Mortality in Scotland 2020/21 - Annexes

Published on 12 October 2021



This document contains the Annexes of the “Winter Mortality in Scotland 2020/21” publication, which provide some additional background information.

Contents

Annex A: How the seasonal increase in mortality is calculated	3
. Definition	3
. Illustrations of the seasonal pattern	3
. An example of the method of calculation	4
. Calculating the seasonal increases for areas within Scotland	5
. Little difference between figures using months of death and registration.....	5
Annex B: Causes of death	7
. Background.....	7
. Statistics of the causes of 'additional' deaths in Scotland	7
. Breaks in the Scottish series for some causes of death.....	8
Annex C: Data collection, comparability, and uses of the statistics	9

These analyses refer to various Tables and Figures. All the material related to this edition of the publication can be found in material which is available via the NRS website's page for this edition of the [publication](#). That page has links to the documents and workbooks for the publication itself, the Tables and the Figures, the Additional Analyses and the Annexes.

In addition, NRS's 'Increased Winter Mortality - Background Note' (available from [the 'home' page for NRS statistics of winter mortality](#)) covers some medical causes of the seasonal increase, research studies' findings on factors that influence it, comparisons of the figures for European countries, previous publications on this topic, and references to the sources of the material.

Annex A: How the seasonal increase in mortality is calculated

Definition

- A1 The seasonal increase in mortality in the winter is defined as the difference between the number of deaths in the 4-month 'winter' period (December to March, inclusive) and the average number of deaths in the two 4-month periods which precede winter (August to November) and follow winter (April to July). This is a standard definition which is used by the Office for National Statistics (ONS), the World Health Organisation and others (who may describe it as – for example - 'excess winter deaths' or 'excess winter mortality'). In passing, it may be noted that some of the previous editions of this publication were called 'Increased Winter Mortality' and 'Excess Winter Mortality'. The title was changed to reduce the likelihood of misunderstandings (because someone seeing, say, 'Increased Winter Mortality in Scotland, 2009/10' might wrongly infer that there had been an increase in winter mortality in that year).

Illustrations of the seasonal pattern

- A2 Because of the effect of the coronavirus (COVID-19), there were many more deaths than normal in some months in 2020 and 2021. Therefore, the statistics for the period from 1 August 2018 to 31 July 2019 illustrate better the 'normal' seasonal pattern. Figure A3 (18-19) shows, using thin vertical lines, the number of deaths that occurred on each day in winter 2018/19, and in the 4-month periods that preceded and followed that winter. The thick black line is a 7-day moving average of the daily numbers of deaths, which smooths out most of the random fluctuations from one day to the next. The broken grey lines above and below the moving average show the likely range of random statistical variation around that moving average. Statistical theory suggests that, if the number of deaths can be represented as the result of a Poisson process, for which the underlying rate at which events (deaths) occur at any given time of year is given by the 7-day moving average, then random day to day variation would result in only about one day in 20 having a figure outwith this range (which is a '95% confidence interval', calculated thus: the underlying rate of occurrence plus or minus 1.96 times its standard deviation; for a Poisson process, the standard deviation is the square root of the underlying rate of occurrence). For example, if (at a particular time of the year) deaths occur at an underlying rate of 150 per day, statistical theory suggests that, on average, 19 out of 20 days would have between 126 deaths and 174 deaths, and so only one day in 20, on average, would have a number of deaths that was outwith that range. As will be seen from the chart, there are some large percentage day-to-day fluctuations in the number of deaths, almost all of which are within the likely range of values that, statistical theory suggests, would arise due to random variation. Finally, the horizontal black lines show the average daily number of deaths for each of the three 4-month periods (August to November, December to March, and April to July). It is clear from Figure A3 (18-19) that, in normal circumstances, the daily number of deaths tends to be highest in the months that are counted as 'winter' for the purpose of these statistics (December to March). However, it is also clear that some of the days in the 'non-winter' months had more deaths than some of the days in the 'winter' months, and that there were times in

the 'non-winter' months when the 7-day moving average was higher than at some of the times in the 'winter' months.

- A3 Figure A3 (19-20) provides the equivalent information for winter 2019/20 and the 4-month periods that preceded it and followed it. It shows that, due to the effects of the coronavirus (COVID-19) pandemic, the daily number of deaths was highest in the period from 30 March 2020 to 27 April 2020: on each of those 29 days, there were at least 223 deaths (including a peak of 305 on 6 April, and several other days with over 270 deaths each). There were more deaths on each of those 29 days than on any day from 1 December 2019 to 29 March 2020 (i.e. more deaths than on any day in winter 2019/20 apart from its last two days – in that period, the highest daily number of deaths was 213, on 29 December). That was also the case for eight of the next eleven days, with at least 216 deaths per day from 29 April to 4 May, and also on 6 and 8 May - so there were more deaths on each of those days than on any day in winter 2019/20 apart from its last two days. Quite clearly, 2019/20 did not follow the normal pattern.
- A4 Similarly, Figure A3 (20-21) provides information for winter 2020/21 and the 4-month periods that preceded it and followed it. It shows that, due to the effects of the coronavirus (COVID-19) pandemic, the daily number of deaths tended to be highest from late December 2020 to mid-February 2021: during that period, the 7-day moving average number of deaths was almost always over 200, reaching a peak of over 230 in the second half of January 2021. As there is a seasonal increase in mortality in the winter, it might not be surprising the death rate was at its highest in that period. However, one would probably not have expected the 7-day moving average number of deaths throughout March 2021 (almost always an average of between 155 and 165 per day) to be well below its level for most of October 2020 (10th to 31st: generally an average of between 165 and 185 per day) and even more clearly lower than in the whole of November (generally an average of between 180 and 200 per day). So, although 2020/21 had its highest death rate in the winter, and its death rate was much lower from April to July, it did not follow the normal pattern either (but it was clearly less abnormal than 2019/20).

An example of the method of calculation

- A5 The total number of deaths registered in each winter, and in the adjacent 4-month periods, are provided in Table 1, along with figures for the seasonal increase in mortality in the winter (sometimes referred to as the 'seasonal difference') which have been calculated from those numbers of deaths. It should be noted that NRS's calculations use the number of deaths that were registered in each period, rather than the number that occurred in each period. There are several reasons for this. For example, it allows NRS to produce the statistics much sooner, as NRS does not have to allow time for the receipt of data in respect of the tiny percentage of deaths which are not registered until, say, several weeks after they occurred. Another reason is that almost all NRS's other published statistics of deaths are based on when those deaths were registered, so this publication's numbers are on the same basis as (for example) those that NRS publishes for individual months and quarters. A third reason is that NRS does not know how many deaths occurred in each month for the years before the start of its death statistics database (1974), so the long-term time-series can be produced only on the basis of when deaths were registered. Paragraph A12 explains why statistics for

Scotland which are produced using the total number of deaths that were registered in 4-month periods should differ only slightly from any figures that might be produced using the numbers of deaths which occurred in 4-month periods.

- A6 Because of the effect of the coronavirus (COVID-19), there were many more deaths than normal in Spring 2020. Therefore, the statistics for 2018/19 are better for illustrating how the seasonal increase in mortality is calculated. Table 1 shows that 20,188 deaths were registered in Scotland in the four months of winter 2018/19 (December 2018 to March 2019). This was more than in the preceding 4-month period (August 2018 to November 2018: 17,864 deaths) and in the following 4-month period (April 2019 to July 2019: 18,398 deaths). The average of the figures for the 4-month periods before and after the winter is 18,131. Taking the difference between that average and the total for the four winter months (20,188 deaths), gives a seasonal increase in mortality of 2,060 for winter 2018/19 (after rounding the result to the nearest ten).
- A7. The figures for the seasonal increase for all the other winters were calculated using the same method. The unusually low seasonal increase of 550 for winter 2019/20 was calculated by subtracting from the 21,392 deaths registered in Scotland in the four months of winter 2019/20 (December 2019 to March 2020) the average of 20,842 deaths registered for the preceding 4-month period (August 2019 to November 2019: 18,973 deaths) and in the following 4-month period (April 2020 to July 2020: 22,712 deaths), and rounding the result. The unusually high seasonal increase of 4,330 for winter 2020/21 was calculated by subtracting from the 23,370 deaths registered in Scotland in the four months of winter 2020/21 (December 2020 to March 2021) the average of 19,041 deaths registered for the preceding 4-month period (August 2020 to November 2020: 19,421 deaths) and in the following 4-month period (April 2021 to July 2021: 18,661 deaths), and rounding the result.

Calculating the seasonal increases for areas within Scotland

- A8 Table HB1 provides the same kind of information as Table 1 but for each NHS Board area for the latest four years, in order to provide examples of the calculation of the seasonal increase in mortality for NHS Board areas; Table LA1 does the same for each Local Council area.
- A9 Table HB2 provides breakdowns of the seasonal increase in mortality in the winter by age and NHS Board area. There are some negative figures: these are cases where a particular age-group had fewer deaths in the winter period than the average of the two adjacent non-winter periods. This happens sometimes because the number of deaths may fluctuate 'randomly' during the year. The 'all ages' figures for the seasonal increase take account of any negative values for individual age-groups. Table LA2 provides the same kinds of figures, but for each Local Authority area; the same points apply.
- A10 In this publication, the statistics for each NHS Board area are based on the boundaries which apply with effect from 1 April 2014. The figures for earlier years show what the numbers would have been, had the new boundaries applied in those years.

Little difference between figures using months of death and registration

A11 Scotland's statistics of winter mortality are calculated using the numbers of deaths which were registered in each 4-month period. However, all three versions of Figure A3 show the number of deaths which occurred on each day in the relevant period. That is because a chart of the number of deaths which were registered on each day would be less informative, as it would have many days on which no deaths were registered (because registration offices were closed at weekends and on public holidays) and, therefore, other days with much higher peaks than those shown in those three Figures (because the deaths which occur on the 365 days of a normal year much be registered on the smaller number of days when the offices are open).

A12 Despite the greater day-to-day fluctuation in the number registered per day, statistics for Scotland which are produced using the total number of deaths that were registered in 4-month periods should differ only slightly from any figures that might be produced using the numbers of deaths which occurred in 4-month periods. This is because, by law, a death which occurs in Scotland must be registered within eight days. Chart 2 in the [Births and Deaths: Days until Registration](#) section of the NRS website shows that, for deaths that were registered in Scotland in 2017, 53% were registered within two days, 81% within four days, 90% within six days, 94% within eight days, 96% within ten days and over 98.7% within 15 days. It follows that statistics which are based on when each death occurred should not differ greatly from those given here, which are based on the date of registration of each death. The total number of deaths registered in the 4-month 'winter' period should be so large as to be only slightly affected (for example) by any year-to-year variation in the number of days in the 'winter' months which had no deaths registered because offices were closed at weekends or on public holidays. Similarly, the total for 'winter' should be only slightly affected by any difference between the numbers of deaths which (i) occurred on or before 30 November but were not registered until on or after 1 December (and so were counted as 'winter' deaths), and (ii) occurred on or before 31 March but were not registered until on or after 1 April (and so were not counted as 'winter' deaths).

Annex B: Causes of death

Background

B1 There is no single cause of 'additional' deaths in winter. Some of Public Health Scotland's reports on influenza (available via the ['Influenza' part of PHS's website](#)) have noted that they are often attributed in part to cold weather directly (for instance deaths following falls, fractures, and road traffic accidents), in part to cold weather worsening chronic medical conditions (for example, heart and respiratory complaints), and in part to respiratory infections including influenza. National Records of Scotland (NRS) data show that very few deaths are directly caused by hypothermia. Before the coronavirus (COVID-19) pandemic, the underlying causes of most of the 'additional' deaths were circulatory system diseases (such as coronary heart disease and stroke), respiratory system diseases (such as pneumonia and chronic obstructive pulmonary disease), dementia and Alzheimer's disease. Influenza is recorded as the underlying cause of a relatively small number of deaths. A separate document, 'Increased Winter Mortality - Background Note', which is available from [the 'home' page for NRS statistics of winter mortality](#), gives information about some of the medical causes of the seasonal increase in mortality in the winter, describes some research studies' findings on factors that influence it, reports on comparisons of the figures for a number of European countries, mentions previous publications on this topic, and provides references to the sources of the material.

Statistics of the causes of 'additional' deaths in Scotland

B2 Table 5 shows the numbers of 'additional' deaths for various categories of underlying causes of death. They are defined using the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10). There may be some apparently very large Increased Winter Mortality Index values, which are based on small unrounded numbers of deaths. For example, a certain winter would have an Index value of 200 (percent) for a particular cause of death / age-group 'cell' if it had two 'additional' deaths and there was, on average, only one death per 4-month non-winter period. One will see particularly high index values for influenza, as it is the underlying cause of very few deaths at other times of the year.

B3 The figures for the latest winter are always provisional, and therefore subject to revision, because, when it produces the figures in August every year, NRS has still to receive final information about the causes of some of the deaths which were registered between January and July of the latest year. In the case of the first figures that were published for winter 2019/20 (In October 2020), there was further uncertainty because, in August 2020 (when the data for the publication were extracted), NRS had also still to receive final information about the causes of some of the deaths which were registered in the later months of 2019. This was because of delays in the production of the results of toxicology tests. At the time, more on this was available from the NRS website, at <https://www.nrscotland.gov.uk/statistics-and-data/future-publications/nrs-publication-schedule-changes>). Usually, it is likely that only a small percentage of the (rounded) numbers of additional deaths will change by more than 10 (based on a comparison of 'provisional' and 'final' figures for winter 2014/15). The categories for which the numbers are most likely to change by more than 10 are 'other external causes of death' and 'ill-defined and unknown

causes': categories for which NRS is more likely to receive further information which changes the classification of the cause of death. (The Index values may have more changes, including some apparently large percentage ones, between their provisional and final versions, due to small revisions to the unrounded numbers from which they are calculated.)

Breaks in the Scottish series for some causes of death

B4 The seasonal increase in deaths from a particular cause is calculated as described in Annex A, but using only figures for deaths with that underlying cause. However, from time to time, changes in the automatic cause of death coding software used by NRS have caused breaks in the continuity of the statistics for some causes of death. The figures in Table 5 are affected by coding changes with effect from the start of 2011 and 2017. They broke the continuity of the seasonal increase for some causes of death around winter 2010/11 and around winter 2016/17, because the seasonal increases for (for example)

- winter 2009/10 were calculated wholly from data coded by the 'old' software (that used for deaths that were registered up to the end of 2010);
- winter 2010/11 were calculated from some data coded by the 'old' software (for deaths registered from August 2010 to December 2010) and some coded by the 'new' software (for deaths registered from January 2011 to July 2011);
- winter 2011/12 were calculated wholly from data coded by the 'new' software (that used for deaths that were registered from the start of 2011).

B5 Papers on the software changes (available from the [Death Certificates and Coding the Causes of Death](#) page of the NRS website) describe the causes of death most affected by the changes in the coding software. From such information, it is likely that (of the causes of death shown in Table 5) the ones most affected by, and the effect on their numbers from, the changes in the software are as follows:

- 2011 changes:
 - pneumonia – reduction in numbers due to the change;
 - other respiratory system diseases – reduction;
 - dementia and Alzheimer's disease – increase;
 - other mental and behavioural disorders and nervous system diseases – reduction;
 - genitourinary system diseases – reduction;
 - other external causes of death – increase;
- 2017 changes:
 - other respiratory system diseases – reduction;
 - dementia and Alzheimer's disease – increase.

The above causes are listed in the order in which they appear in Table 5. It is not possible to quantify the effect on their figures because (in general) the papers' estimates of such effects are for different causes (or groups thereof). From the papers, one can determine which of the categories in Table 5 would be affected markedly by the software changes, and whether their numbers would have increased or decreased as a result, but not by how much their seasonal increases might have changed (which, in any case, could well be small relative to some of the year-to-year fluctuations in the seasonal increase in mortality).

Annex C: Data collection, comparability, and uses of the statistics

- C1 NRS collects the underlying data on a daily basis, as and when each death is registered. The statistics for the latest winter are all new. The figures for the previous winter may have been revised very slightly.
- C2 Information about (for example) the sources, methods, definitions and reliability of statistics of deaths is available from the following NRS web site pages [general background information on Vital Events statistics](#) and [background information on points which are specific to statistics about deaths](#).
- C3 Scottish figures for the seasonal increase in mortality are directly comparable with those for other parts of the UK. There are some differences across the UK in how the data used to produce statistics of deaths are collected and processed, but they are relatively minor, particularly for the purpose of estimating the seasonal increase in mortality. As explained in Annex A, any statistics for Scotland that were produced using the total number of deaths that occurred in 4-month periods (a method used elsewhere in the UK) would differ only slightly from those that are given in this publication, which were produced using the numbers of deaths that were registered in 4-month periods.
- C4 The figures for the latest winter, and the subsequent four month period, given here are provisional. They were produced from the statistical information that NRS had on Friday 20 August 2021, which included data for deaths which had been registered by Wednesday 18 August 2021. Therefore, records for all the deaths which were registered in the winter (December to March), or in the subsequent 4-month period (April to July), should have been added to NRS's statistical database before the tables for this release were produced. However, the overall figures could change slightly, because occasionally, due to unusual circumstances, it may be a long time before a particular registration record is added to NRS's statistical database. In addition, in the '2018/19' edition, some of the figures back to winter 2014/15 were revised slightly (see paragraph 6.3 of that edition). There may also be changes in the breakdown by the cause of death (as mentioned in paragraph B3 of Annex B) because NRS does not 'freeze' its statistical data for a given year until it starts to prepare the final statistics for the calendar year as a whole (which are published in the following summer), by which time it will have received final information about the causes of some of the deaths.
- C5 Statistics of the seasonal increase in mortality in the winter inform public debate and the development of government policy on matters such as the health of the elderly population, fuel poverty and whether there is a need to improve the housing stock in terms of central heating and thermal insulation.

© Crown Copyright 2021

You may use or re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. Further is available within the [Copyright & Disclaimer](#) section of the National Records of Scotland website.